

WHAT IS CLAIMED IS:

1           1.     A data relay apparatus comprising:  
2                 a first group of one or more data ports;  
3                 a second group of one or more data ports; and  
4                 a controller configured to receive data from data ports of said first group and  
5     to transmit all of said data via data ports of said second group;  
6                 said controller configured to receive data from data ports of said second group  
7     and to transmit all of said data via data ports of said first group;  
8                 said controller configured to disable all data ports of said second group in  
9     response to detecting that data communication is not available via any data port of said first  
10    group,  
11                 said controller configured to disable all data ports in said first group in  
12    response to detecting that data communication is not available via any data port in said  
13    second group.

1           2.     The data relay apparatus of claim 1 wherein said controller is further  
2     configured to enable all data ports of said first and second groups when all of said data ports  
3     have been disabled for a first period of time, to determine if communication is available via  
4     any data port of said first group or via any data port of said second group, and to disable all of  
5     said data ports if it is determined that said communication is not available.

1           3.     The data relay apparatus of claim 1 wherein said controller is further  
2     configured to send test data through data ports of said first group and of said second group to  
3     detect whether data communication is available via said data ports.

1           4.     The data relay apparatus of claim 3 wherein said test data include  
2     ICMP (internet control management protocol) ECHO requests, or ARP (address resolution  
3     protocol) messages, or LACP (link aggregation control protocol) control messages.

1           5.     The data relay apparatus of claim 1 wherein said controller is further  
2     configured to monitor data ports of said first group and of said second group for hardware  
3     error conditions in said data ports to detect whether data communication is available via said  
4     data ports.

1           6.       The data relay apparatus of claim 1 as incorporated in a data relay  
2 system, said data relay system comprising at least a first one of said data relay apparatus, a  
3 second one of said data relay apparatus, and a third one of said data relay apparatus,  
4           data ports of said first group in said first data relay apparatus being configured  
5 for data communication with a data terminal,  
6           data ports of said first group in said second data relay apparatus being  
7 configured for data communication with said data terminal,  
8           data ports of said second group in said first data relay apparatus being in data  
9 communication with data ports of said first group in said third data relay apparatus,  
10          data ports of said second group in said second data relay apparatus being in  
11 data communication with data ports of said first group in said third data relay apparatus,  
12          wherein data transmission between said data terminal and said third data relay  
13 apparatus occurs via said first data relay apparatus or via said second data relay apparatus.

1           7.       The data relay apparatus of claim 1 further including at least a third  
2 group of one or more data ports and a fourth group of one or more data ports,  
3           said controller further configured to transmit all first data received from data  
4 ports of said first and third groups to data ports of said second group or to data ports of said  
5 fourth group based on information contained in said first data,  
6           said controller further configured to transmit all second data received from  
7 data ports of said second and fourth groups to data ports of said first group or to data ports of  
8 said third group based on information contained in said second data,  
9           said controller further configured to disable all data ports of said first, second,  
10 third, and fourth groups in response to detecting that data communication is not available via  
11 any data port of said first group and via any data port of said third group,  
12           said controller further configured to disable all data ports of said first, second,  
13 third, and fourth groups in response to detecting that data communication is not available via  
14 any data port of said second group and via any data port of said fourth group.

1           8.       The data relay apparatus of claim 7 as incorporated in a data relay  
2 system comprising at least a first one of said data relay apparatus, a second one of said data  
3 relay apparatus, a third one of said data relay apparatus, and a fourth one of said data relay  
4 apparatus,

data ports of said second group in said first data relay apparatus being in data communication with data ports of said first group in said third data relay apparatus, data ports of said fourth group in said first data relay apparatus being in data communication with data ports of said first group in said fourth data relay apparatus, data ports of said second group in said second data relay apparatus being in data communication with data ports of said third group in said third data relay apparatus, data ports of said fourth group in said second data relay apparatus being in data communication with data ports of said third group in said fourth data relay apparatus.

9. A data relay apparatus comprising:  
a first plurality of data ports;  
a second plurality of data ports; and  
a controller configured to receive first data from said first data ports and to transmit all of said first data via one or more of said second ports, said controller further configured to receive second data from said second ports and to transmit all of said second data via one or more of said first ports;  
said controller further configured to determine if communication is not possible via any of said first data ports by transmitting test data via said first data ports and if communication is not possible via any of said first data ports to disable all of said first and second data ports,  
said controller further configured to determine if communication is not possible via any of said second data ports by transmitting test data via said second data ports and if communication is not possible via any of said second data ports to disable all of said first and second data ports.

10. The data relay apparatus of claim 9 wherein said controller is further configured:  
to re-enable all of said first and second data ports after a first period of time;  
to re-determine if communication is possible via any of said first data ports and via any of said second data ports; and  
if not to disable all of said first and second data ports.

11. The data relay apparatus of claim 9 wherein said test data include ICMP (internet control management protocol) ECHO requests, or ARP (address resolution protocol) messages, or LACP (link aggregation control protocol) control messages.

1           12. In a data relay apparatus having a plurality of data ports, a method for  
2 relaying data comprising:  
3           receiving first data from a first group comprising one or more of said data  
4 ports;  
5           receiving second data from a second group comprising one or more of said  
6 data ports;  
7           transmitting all of said first data via data ports of said second group;  
8           transmitting all of said second data via data ports of said first group; and  
9           determining whether transmission of data is not successful via any of said data  
10 ports of said first group or via any of said data ports of said second group and if so disabling  
11 all data ports of said first and second groups.

1           13. The method of claim 12 further including, subsequent to said disabling,  
2 enabling all data ports of said first and second groups, determining whether transmission of  
3 data is not successful via any of said data ports of said first group or via any of said data ports  
4 of said second group, and, if so, disabling all data ports of said first and second groups.

1           14. The method of claim 12 wherein said determining includes  
2 transmitting first test data through data ports of said first group and transmitting second test  
3 data through data ports of said second group.

1           15. The method of claim 14 wherein said first and second test data include  
2 ICMP (internet control management protocol) ECHO requests, or ARP (address resolution  
3 protocol) messages, or LACP (link aggregation control protocol) control messages.

1           16. The method of claim 12 wherein said determining includes detecting  
2 error conditions in circuitry comprising data ports of said first group and said second group.

1           17. The method of claim 12 wherein a first one of said data relay  
2 apparatus, a second one of said data relay apparatus, and a third one of said data relay  
3 apparatus is incorporated in a data switching system, said method further including:  
4           transferring third data between a data source and data ports of said first group  
5 in said first and second data relay apparatuses;  
6           transferring said third data between data ports of said second group in said  
7 first and second data relay apparatuses and data ports in said third data relay apparatus,

wherein data transfer between said data source and said third data relay apparatus can occur via said first data relay apparatus or via said second data relay apparatus.

18. The method of claim 12 further including:  
receiving third data from a third group comprising one or more of said data ports;  
receiving fourth data from a fourth group comprising one or more of said data ports;  
transmitting all of said first data via data ports of said second group or via data ports of said fourth group, depending on information contained in said first data;  
transmitting all of said second data via data ports of said first group or via data ports of said third group, depending on information contained in said second data;  
transmitting all of said third data via data ports of said second group or via data ports of said fourth group, depending on information contained in said third data;  
transmitting all of said fourth data via data ports of said first group or via data ports of said third group, depending on information contained in said fourth data;  
determining whether transmission of data is not successful via any of said data ports of said first and third groups and if so disabling data ports of said first, second, third, and fourth groups; and  
determining whether transmission of data is not successful via any of said data ports of said second and fourth groups and if so disabling data ports of said first, second, third, and fourth groups.

19. The method of claim 18 wherein a first one of said data relay apparatus, a second one of said data relay apparatus, a third one of said data relay apparatus, and a fourth one of said data relay apparatus are incorporated in a data switching system, said method further comprising:  
transferring fifth data between a first data source and data ports of said first group in said first data relay apparatus;  
transferring said fifth data between data ports of said second and fourth groups in said first data relay apparatus and data ports in said third and fourth data relay apparatuses;  
transferring sixth data between said first data source and data ports of said first group in said second data relay apparatus;



4 successful data transmission and in response thereto disabling all data ports of said first and  
5 second groups.

1 23. The apparatus of claim 21 wherein said means for detecting includes  
2 means for transmitting test data through said data ports.

1 24. The apparatus of claim 23 wherein said test data includes ICMP  
2 (internet control management protocol) ECHO requests, or ARP (address resolution protocol)  
3 messages, or LACP (link aggregation control protocol) control messages.

1 25. The apparatus of claim 21 wherein said means for detecting includes  
2 means for detecting error conditions in the circuitry comprising said data ports.

1 26. A data relay system comprising:  
2 a first data relay apparatus;  
3 a second data relay apparatus;  
4 a third data relay apparatus; and  
5 at least a fourth data relay apparatus,  
6 each of said relay apparatuses comprising:  
7 a plurality of first data ports;  
8 a plurality of second data ports; and  
9 a controller configured to receive data from one of said first data ports  
10 and to transmit said data via one of said second data ports, based on information contained in  
11 said data;  
12 said controller configured to disable all of said second data ports in  
13 response to detecting that data communication is not available via any of said first data ports,  
14 said controller configured to disable all of said first data ports in  
15 response to detecting that data communication is not available via any of said second data  
16 ports,  
17 said second data ports of said first data relay apparatus, each configured for  
18 data communication with one of said first data ports of either said third data relay apparatus  
19 or said fourth data relay apparatus,  
20 said second data ports of said second data relay apparatus, each configured for  
21 data communication with one of said first data ports of either said third data relay apparatus  
22 or said fourth data relay apparatus.

1                   27.     The system of claim 26 further including a first data terminal and a  
2     second data terminal, each of said data terminals configured to send data to said first data  
3     ports of said first and second data relay apparatuses, wherein each of said data terminals can  
4     communicate with said third and fourth data relay apparatuses via said first data relay  
5     apparatus or via said second data relay apparatus.